

MATHEMATICAL ASSOCIATION



Supporting mathematics in education

THE MATHEMATICAL ASSOCIATION NEWSLETTER

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From the President

A journey from pupil to researcher.

In these MA News pieces, I want to avoid just duplicating the sorts of things I write in Mathematics in School or in the Presidential blogposts. It was suggested to me that people might be curious to know a bit about my background. I generally avoid writing about myself, and much prefer to focus on mathematics and teaching and learning. But I'm going to make an exception here. However, personally, I tend to skip pieces like this, and, if you're the same, then please feel free to do so!

I grew up in Coventry in the 1970s-80s, and, from a very young age, I thought about being a teacher although not necessarily a mathematics teacher. I always loved school, and thought that the teachers were amazing, and I liked learning about everything. I did very well at school and was a highly academic kind of child. My parents valued education, although they hadn't had lots of opportunities themselves. My father had left school at 14, as you could in those days, and so had never done any examinations. And no one in my wider family had done O-levels, let alone A-levels or gone to university. My mother was a stay-at-home mother, and throughout my childhood my father moved from job to job, interspersed with periods of unemployment, often as a result of redundancy when companies went bust. He began as a milkman with the Co-op, and eventually ended up in security work as a factory nightwatchman. So, when I did well at school and showed interest in teaching, this was seen as a very good thing. Teaching was viewed as a 'safe job': a 'job for life', with strong unions, good pay, a good pension and, of course, as everyone knows, excellent holidays!

I enjoyed all subjects at school – particularly mathematics and science, but also reading and writing stories. At the primary school I went to, knowing your tables early and being fast at mental calculation got you a long way, and so I was treated as a 'maths genius', although the bar was very low and I really knew very little about mathematics. I don't recall any mathematics at primary school other than pages of 'sums', but I was content at the time to complete book after book of these. I was never bored in school, because I was always

very interested in other children's thinking, and how teachers went about their job. Even if I knew the things that were being taught, I interested myself in the pedagogy, and it was always obvious to me that there was much more to teaching something



than merely knowing that thing.

For secondary school, I went to a large comprehensive, which I also loved. I did extra-curricular activities in every lunchtime and after-school slot, and, in those days, schools were far more relaxed about missing lessons. In the run-up to a school play or concert, I would seemingly miss weeks of lessons across all subjects in order to be involved, and no one minded. I took advantage of free, weekly instrument lessons – I wanted to learn the violin, but my school had no spare violins to lend out, but they had a spare viola, so I learned that instead.

(Continued on page 3)

CONTENTS

- 1. From the President
- 2. First Mathematics Challenge (FMC)
- 2. Primary Mathematics Challenge (PMC).
- 3-4. From the President (continued)
- 5-8. Annual MA Conference 2022. Delegate Reviews.
- 9. AGM 2022 Report from Chair of Council.
- 10. AGM 2022 Election Results.
- 11. AGM 2022 Financial Statements.
- 11. Meet the new Editor-in-Chief.
- 12. 'Coming Together' a merger update.
- 13. News from Council.
- 13 News from Committees. Branches.
- 14. News from Committees Teaching Committee.
- 15. Notice of the passing of friends.
- 15. Recent MA publications.
- 16. Dates, Abbreviations.

From the President (continued from page 1)

This turned out to be good, because orchestras are always short of violas, and so I soon managed to get into the excellent Coventry Youth Orchestra, despite not being very advanced. I also studied at the Coventry Centre for the Performing Arts every Saturday for 7 years, and did GCSE and A-level music through that. There was a nominal charge for this, but it was something like f_{1} per term, which was no barrier. At that time, Local Education Authorities were strong and heavily subsidised things like music.

At this age, science and mathematics were my main interests, and I worked my way through a large number of books from the school and city public libraries. There was no internet shopping in those days, and I didn't know about things like 'university bookshops', so I didn't come across the kinds of books that would have been most helpful. Many of the books I did find were quite out of date, so I became used to calculating with values like 32 ft/s². My hobbies were soldering electronic circuits together and doing chemistry experiments. I managed to obtain chemicals from chemical suppliers that would today no doubt identify me as a child to be concerned about: concentrated nitric, sulfuric and hydrochloric acids, mercury(II) oxide and sodium and potassium metals in oil. I was very careful with my practical experiments in the kitchen, and never had any serious accidents, although I remember my mother once asking my science teacher at a parents' evening whether this was all OK. I will always be grateful to him that he apparently replied to her, "Don't worry - he knows what he's doing". I can't imagine any teacher today feeling able to give reassurance like that!

In science and mathematics I learned things by myself some time before they were taught in school, and I think that really contributed to my interest in teaching. I watched carefully how teachers would explain things, and I began to notice what they included or omitted, how they sequenced things and how they dealt with questions and difficulties. I admired the teachers greatly, especially as students' behaviour was often challenging, and senior teachers would have to be sent for to come and drag out fighting students with blood running down their faces.

Thinking back, I suspect it must have been a student teacher (although I wasn't aware of this at the time) who My school didn't offer Further Mathematics at A-level, appeared when I was in my first year at secondary school (age 11-12), and took out supposedly the 'top' three students from each of the two top mathematics sets for 'extraction maths'. The six of us went with this teacher once a week to a small classroom, where we did

'investigations', and this was an approach to mathematics that I had never experienced before. I remember exploring Pascal's triangle, Fibonacci sequences and finding the number of squares a diagonal passes through in an $n \times m$ rectangle. We were largely left to get on with these tasks, and I continued working on them extensively at home, and wrote them up in lots of detail for my own interest. In these lessons, we watched the MI10 - Mathematical Investigations series on BBC TV, which I have since discovered was devised by the likes of Professor John Mason and Professor Barbara Jaworksi - people I am now privileged to count as friends and colleagues. So, I was influenced by their thinking all the way back when I was at school.

The other way that John Mason had an influence on me back then was through the Open University TV programmes, which I discovered by chance one day at home. Once I had found these, I used to get up early and stay up late to watch the mathematics and science ones. Many of these courses were intended for people without formal qualifications, and so they were much more accessible than they might sound. But they went up to university-level content and were beautifully produced, with great plastic models and animations. I must have spent hundreds of hours watching these, and I first encountered lots of the big ideas in mathematics there.

Around that time, the science books that I was reading involved calculus, but I didn't know what calculus was, so I couldn't understand those parts. I copied out the integral sign from one of these books onto a piece of paper and took it in to ask my physics teacher what it was. She said, "That's calculus - you'll learn it at Alevel", and this was really helpful, because then I knew what kind of book I needed to find. (There was of course no internet then.) In the public library, I found a book called Teach Yourself Calculus, and, according to the preface, the prerequisites for this were Teach Yourself Algebra and Teach Yourself Trigonometry. So, I worked through TYA and TYT, doing all the exercises, and then, finally, TYC. And, once I had completed that, I could pretty much make sense of all the science books that I wanted to read. I particularly enjoyed the Feynman Lectures on Physics, but I found those really hard going, and even now there's lots in them I don't understand.

and, even though I had completed all the material from the textbooks, the head of mathematics didn't feel that he or anyone in his department was competent to help me with it,

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From the President (continued from page 3)

or check whether I was doing it right, and so he didn't want me to risk not getting an A (the top grade then) in it. (There was no *Further Mathematics Support Programme* in those days.) So, I didn't take it, which seemed really bad at the time, and I remember being very disappointed about it, but it didn't actually matter in the end. I also didn't know about the Mathematics Challenges and Olympiads, so I never did those.

My teachers were hugely supportive. None of them had known anyone who had gone to Oxford or Cambridge, but one of the science teachers suggested that I should apply. I chose to study science, rather than mathematics, because I (very naïvely) thought that I could always learn mathematics on my own, in the library, like I had been doing, whereas to learn science properly you needed labs to do experiments in. So, science seemed to make better use of going off to a university. I discovered that at Cambridge you could do Natural Sciences, and so I didn't have to choose just one science subject, and that made me choose Cambridge over Oxford. People didn't waste money going to open days in those days, and I had never visited either city - but why would I need to? Of course I would go there if they would have me! To my family, Cambridge seemed like a world away - neither of my parents has ever held a passport or left the UK: foreign holidays were for 'posh' people!

At university, I was entitled to a full grant, which covered everything. In fact, I had never been so rich, as college food and accommodation were cheap, and I could even send some money home to my parents. I did as much mathematics as it is possible to do in a Natural Sciences degree, which is more than is in many mathematics degrees, and as much as a theoretical physicist would do. Initially, I had an idea of trying to keep up with the people doing mathematics degrees, by arranging for them to get me a spare copy of the lecture notes and problem sheets. But this turned out to be much too hard, as even in their first term they were doing topics I'd never heard of. But I often went to lectures that weren't part of my courses – which was allowed – as I just found everything so interesting.

I eventually specialised in chemistry, and afterwards went on to do a PhD. At that time, if you got a first you were basically offered a PhD place, and it was just a matter of deciding who you wanted to have as your supervisor. I loved research, and assumed that I would probably continue as an academic in chemistry, but my hands disagreed, and didn't like being in chemicals all day in a wet lab. Although I'd done practical work as an undergraduate, that was just for a few afternoons a

week, whereas doing a lab-based PhD you were in the lab all day long, day after day. Under those conditions, the solvents dried out my hands, and they cracked and bled, and, despite trying every kind of gloves and cream I could find, nothing helped. So this was part of my reason for moving towards mathematics.

I had already decided to do a PGCE. One of the highlights of my PhD was supervising undergraduates in pairs or threes, in 60-minute 'supervisions', once a week (the 'Cambridge system'). I did far more of these than most PhD students do, and I ended up supervising for 9 different colleges. I would supervise all of the chemistry modules in Year 1, and the 'organic chemistry' ones in Years 2 and above. At my peak, while writing up my PhD, I was doing more than 20 supervisions a week, and I learned a lot from this intensive experience. Unlike with lecturing, with one-to-one tutoring you get immediate feedback if your explanations are not making sense or if students can't do the problems, so there is nowhere to hide, and this was a great experience for me. And I earned enough money to buy a car! I also got the opportunity to write, administer and mark mock examinations and do examination invigilation. I also used to do laboratory 'demonstrating', which meant teaching groups of undergraduates every week as they did their practical work in the lab for a day or half-day at a time. I enjoyed all of this a lot, and so I initially considered doing a science PGCE, but eventually switched it to mathematics.

Since completing my PGCE in secondary mathematics, I've remained focused on mathematics education, although I've occasionally taught bits of science and other subjects in schools. After 12 years of teaching mathematics in schools, I moved into academia and have worked at the University of Nottingham, University of Leicester and, now, Loughborough University. So that's how I got to where I am now. And well done if you made it all the way through reading all of this!

> Colin Foster MA President 2022-23

p.s. Colin is delivering a number of MA events during his year as President. Examples include:

Sat 9 July, AMT/MA meeting, UCL Institute of Education, London. Title: There are no boring mathematics topics!

Tuesday 11 October 4:00pm - 5:30pm, MA webinar Title: Butterfly effects when designing and adapting tasks.

4